ACCES I/O PRODUCTS INC
10623 Roselle Street, San Diego, CA 92121
TEL (858)550-9559 FAX (858)550-7322

MODEL PCI-ICM422(485)/2(4)

USER MANUAL

FILE: MPCI-ICM4S.F1b

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Chapter 1: Introduction

These cards provide effective asynchronous serial communications in RS422 and RS485 networks on long communications lines in noisy environments. The cards feature independent serial ports and use type 16550 buffered UARTs. The data lines are opto-isolated from the computer and from each other to assure communication through large common mode noise.

Both the RS422 and RS485 cards are 12.283 inches (312 mm) long and may be installed in 5-volt PCI-bus slots of IBM PC or compatible computers. For Windows compatibility, the cards feature automatic control in the RS485 mode to transparently enable/disable the transmission drivers.

RS422 Balanced Mode Operation

The PCI-ICM422/2 and PCI-ICM422/4 support RS422 communications and use differential balanced drivers for long cables and high noise immunity. These cards also have the capability to add load resistors to terminate the communications lines. RS422 communications requires that a transmitter supply a bias voltage to ensure a known "zero" state. Also, receiver inputs at each end of the network should be terminated to eliminate "ringing". These cards support biasing by default and support termination by jumpers on the card. If your application requires the transmitter to be un-biased, please contact the factory.

RS485 Balanced Mode Operation

The PCI-ICM485/2 and PCI-ICM485/4 support RS485 communications and also use differential balanced drivers for long range and high noise immunity. RS485 operation involves switchable transceivers and the ability to support multiple devices on a single "party line". The RS485 specification defines a maximum of 32 devices on a single line. The number of devices served on a single line can be expanded by use of "repeaters".

PCI-ICM485/2 and PCI-ICM485/4 also have the capability to add load resistors to properly terminate the communications lines. Receiver inputs at each end of the network should be terminated to eliminate 'ringing". Also, RS485 communications requires that one transmitter supply a bias voltage to ensure a known "zero" state when all transmitters are off. These cards support biasing by default and support termination by jumpers on the card. If your application requires the transmitter to be un-biased, please contact the factory.

COM Port Compatibility

Type 16550 UARTs are used as the Asynchronous Communication Element (ACE). These include a 16-byte transmit/receive buffer to protect against lost data in multitasking operating systems, while maintaining 100 percent compatibility with the original IBM serial port.

A crystal oscillator is located on the card. This oscillator permits precise selection of baud rates up to 115,200 or, by changing a jumper, up to 460,800 with the standard crystal oscillator.

The driver/receiver used, the SN75176B, is capable of driving extremely long communication lines at high baud rates. It can drive up to ±60 mA on balanced lines and receive inputs as low as a 200 mV differential signal superimposed on common mode noise of +12 V or -7 V. In case of communication conflict, the driver/receivers feature thermal shutdown.

Communication Mode

PCI-ICM422/2 and PCI-ICM422/4 support Full-Duplex and Half-Duplex communications with a 4-wire cable connection. PCI-ICM485/2 and PCI-ICM485/4 support Half-Duplex communications with a 2-wire cable connection. Half-Duplex allows traffic to travel in both directions, but only one way at a time. RS485 communications commonly use the Half-Duplex mode since they share only a single pair of wires and installation cost is reduced.

Baud Rate Ranges

The card has capability for two baud rate ranges, selectable on a port-by-port basis. One range is for up to 115,200-baud applications and the other is for up to 460,800-baud applications. Refer to Baud Rate Divisor Table on page 5-2 of the manual.

Auto-RTS Transceiver Control

In RS485 communications, the driver must be enabled and disabled as needed, allowing all cards to share a 2-wire cable. The PCI-ICM485/2 and PCI-ICM485/4 cards control the individual drivers automatically. With automatic control, the driver is enabled when data are ready to be transmitted. The driver remains enabled after data transmission is complete for one additional character's transmission time and then is disabled. The receiver is also normally enabled, then disabled during RS485 transmissions, and then re-enabled after transmission is completed (plus that one character transmission time). These cards automatically adjust their timing to the baud rate of the data. (The automatic control feature makes the cards ideal for WIN95 applications)

Input/Output Connections

These cards use a 37-pin DBM connector and a breakout cable. The breakout cable terminates in a DB9 connector for each port. Those DB9 connectors are equipped with 4-40 threaded standoffs (female screw lock) to provide strain relief. The mating connector is AMP type 17D-E9s or equivalent. We recommend using vinyl-jacketed, multiple, twisted-pair cable.

The card is also available without this cable. If your card was purchased without the cable, there will be an "S1" appended to the model number.

To ensure that there is minimum susceptibility to EMI and minimum radiation, it is important that the card mounting bracket be properly screwed into place and that there be a positive chassis ground. Also, proper EMI cabling techniques (cable connect to chassis ground at the aperture, shielded twisted-pair wiring, etc) should be used for the input/output wiring.

Specifications

Communications Interface

- I/O Connection: 37 Pin DBM connector.
- Serial Ports: An external breakout cable that terminates with female D-sub 9-pin connectors.
- Character length: 5, 6, 7, or 8 bits.
- Parity: Even, odd or none.
- Stop Interval: 1, 1.5, or 2 bits.
- Serial Data Rates: Up to 115,200 baud, asynchronous, A faster range of rates, up to 460,800 baud, is achieved by jumper selection on the card. A type 16550 buffered UART is used and has FIFO buffer.
- Address: Continuously mappable within 0000 to FFFF (hex) range of PCI bus addresses.
- Receiver Input Sensitivity: ±200 mV, differential input.
- Common Mode Rejection: +12V to -7V.
- Transmitter Output Drive Capability: 60 mA, with thermal shutdown.

Environmental

- Operating Temperature Range: 0 °C. to +60 °C.
- Storage temperature Range: -50 °C. to +120 °C.
- Humidity: 5% to 95%, non-condensing.

- Power Required: +5VDC at 125 mA typical, -12VDC at 5 mA typical, +12VDC at 5 mA typical, 750 mW total power consumption (four-port cards).
- Size: 12.283 inches long (312 mm).

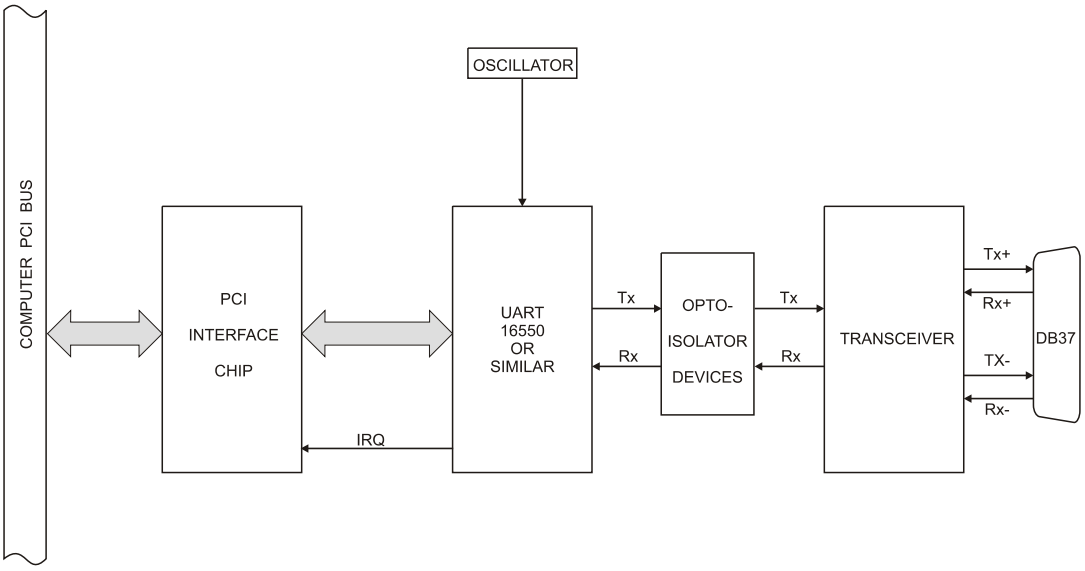

Figure 1-1: PCI-ICM422/2/4 Block Diagram
(Only one serial channel shown)

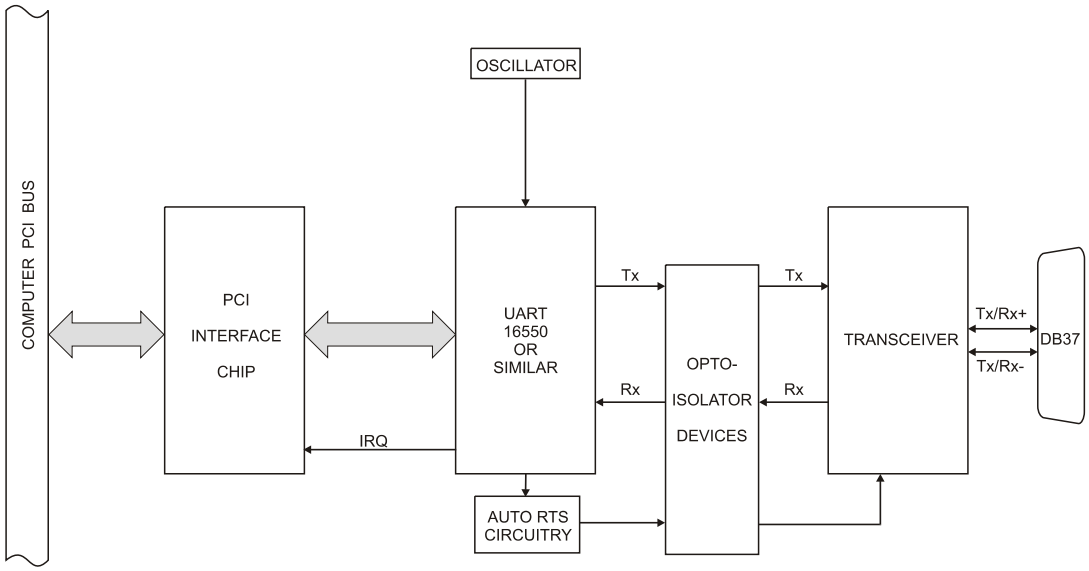

Figure 1-2: PCI-ICM485/2/4 Block Diagram

Chapter 2: Installation

The software provided with this card is contained on either one CD or multiple diskettes and must be installed onto your hard disk prior to use. To do this, perform the following steps as appropriate for your software format and operating system. Substitute the appropriate drive letter for your CD-ROM or disk drive where you see d: or a: respectively in the examples below.

CD Installation

DOS/WIN3.x

1. Place the CD into your CD-ROM drive.
2. Type D : Enter to change the active drive to the CD-ROM drive.
3. Type I N S T A L L Enter to run the install program.
4. Follow the on-screen prompts to install the software for this card.

WIN95/98/NT/2000

a. Place the CD into your CD-ROM drive.
b. The CD should automatically run the install program after 30 seconds. If the install program does not run, click START | RUN and type d:install, click OK or press Enter.
c. Follow the on-screen prompts to install the software for this card.

3.5-Inch Diskette Installation

As with any software package, you should make backup copies for everyday use and store your original master diskettes in a safe location. The easiest way to make a backup copy is to use the DOS DISKCOPY utility.

In a single-drive system, the command is:

D I S K C O P Y A : A : Enter

You will need to swap disks as requested by the system.
In a two-disk system, the command is:

D I S K C O P Y A : B : Enter

This will copy the contents of the master disk in drive A to the backup disk in drive B.

To copy the files on the master diskette to your hard disk, perform the following steps.

a. Place the master diskette into a floppy drive.

b. Change the active drive to the drive that has the diskette installed. For example, if the diskette is in drive A, type A : Enter.

c. Type I N S T A L L Enter and follow the on-screen prompts.

Directories Created on the Hard Disk

The installation process will create several directories on your hard disk. If you accept the installation defaults, the following structure will exist.

[CARDNAME]

Root or base directory containing the SETUP.EXE setup program used to help you configure jumpers and calibrate the card.

DOS\PSAMPLES: A subdirectory of [CARDNAME] that contains Pascal samples.
DOS\CSAMPLES: A subdirectory of [CARDNAME] that contains "C" samples.
Win32\language: Subdirectories containing samples for Win95/98 and NT.

WinRISC.exe

A Windows dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem.

ACCES32

This directory contains the Windows 95/98/NT driver used to provide access to the hardware registers when writing 32-bit Windows software. Several samples are provided in a variety of languages to demonstrate how to use this driver. The DLL provides four functions (InPortB, OutPortB, InPort, and OutPort) to access the hardware.

This directory also contains the device driver for Windows NT, ACCESNT.SYS. This device driver provides register-level hardware access in Windows NT. Two methods of using the driver are available, through ACCES32.DLL (recommended) and through the DeviceIOControl handles provided by ACCESNT.SYS (slightly faster).

SAMPLES

Samples for using ACCES32.DLL are provided in this directory. Using this DLL not only makes the hardware programming easier (MUCH easier), but also one source file can be used for both Windows 95/98 and WindowsNT. One executable can run under both operating systems and still have full access to the hardware registers. The DLL is used exactly like any other DLL, so it is compatible with any language capable of using 32-bit DLLs. Consult the manuals provided with your language's compiler for information on using DLLs in your specific environment.

VBACCES

This directory contains sixteen-bit DLL drivers for use with VisualBASIC 3.0 and Windows 3.1 only. These drivers provide four functions, similar to the ACCES32.DLL. However, this DLL is only compatible with 16-bit executables. Migration from 16-bit to 32-bit is simplified because of the similarity between VBACCES and ACCES32.

PCI

This directory contains PCI-bus specific programs and information. If you are not using a PCI card, this directory will not be installed.

SOURCE

A utility program is provided with source code you can use to determine allocated resources at run-time from your own programs in DOS.

PCIFind.exe

A utility for DOS and Windows to determine what base addresses and IRQs are allocated to installed PCI cards. This program runs two versions, depending on the operating system. Windows 95/98/NT displays a GUI interface, and modifies the registry. When run from DOS or Windows3.x, a text interface is used. For information about the format of the registry key, consult the card-specific samples provided with the hardware. In Windows NT, NTioPCI.SYS runs each time the computer is booted, thereby refreshing the registry as PCI hardware is added or removed. In Windows 95/98/NT PCIFind.EXE places itself in the boot-sequence of the OS to refresh the registry on each power-up.

This program also provides some COM configuration when used with PCI COM ports. Specifically, it will configure compatible COM cards for IRQ sharing and multiple port issues.

WIN32IRQ

This directory provides a generic interface for IRQ handling in Windows 95/98/NT. Source code is provided for the driver, greatly simplifying the creation of custom drivers for specific needs. Samples are provided to demonstrate the use of the generic driver. Note that the use of IRQs in near-real-time data acquisition programs requires multi-threaded application programming techniques and must be considered an intermediate to advanced programming topic. Delphi, C++ Builder, and Visual C++ samples are provided.

Findbase.exe

DOS utility to determine an available base address for ISA bus , non-Plug-n-Play cards. Run this program once, before the hardware is installed in the computer, to determine an available address to give the card. Once the address has been determined, run the setup program provided with the hardware to see instructions on setting the address switch and various option selections.

Poly.exe

A generic utility to convert a table of data into an nth order polynomial. Useful for calculating linearization polynomial coefficients for thermocouples and other non-linear sensors.

Risc.bat

A batch file demonstrating the command line parameters of RISCTerm.exe.

RISCTerm.exe

A dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem. RISCTerm stands for Really Incredibly Simple Communications TERMinal.

Installing the Card

These cards can be installed in a five-volt PCI slot of an IBM or compatible computer. Before , carefully read the Option Selection section of this manual and configure the card according to your requirements. Finally, our SETUP.EXE program will lead you through the process of setting the options on the card. The setup program does not set the options. These must be set manually by jumpers on the card.

To Install the Card

1. Turn OFF computer power.
2. Remove the computer cover.
3. Install the jumpers as shown in the Option Selection section of this manual or the SETUP.EXE software program.
4. Install the card in an available PCI-bus slot.
5. Replace the computer cover and turn ON the computer.
6. Enter the CMOS setup program of your system and verify that the PCI plug-and-play option is set appropriately for your system. Systems running Windows95 (or any other PNP-compliant Operating System) should set the CMOS option to OS. Systems running under DOS, WindowsNT 3.51, Windows 3.1, or any other non-PNP-compliant Operating System should set the PNP CMOS option to BIOS or Motherboard. Save the option and continue booting the system.

Inspect for proper fit of the card and tighten screws. Make sure the card's mounting bracket is properly screwed into place and that there is a positive chassis ground.

Input/Output Connections

A 37-pin D connector is on the mounting bracket and a three-foot-long breakout cable is included with the cards. That breakout cable terminates in separate 9-pin DBM connectors; one DB9 per port.

If desired, the cards can be purchased without this breakout cable. In this latter case, an "S1" is added to the model number to signify absence of the breakout cable; viz PCI-ICM485/4S1.

Chapter 3: Option Selection

To help you locate the jumpers described in this section, refer to the Option Selection Map at the end of this chapter. Operation is determined by jumper installation as described in the following paragraphs.

Terminations

A transmission line should be terminated at the receiving end in its characteristic impedance. Installing a jumper at the locations labeled LDO and LDI apply 120Ω loads across the transmit (LDO)and receive (LDI) lines.

Figure 3-1: Simplified Termination Schematic

In operations where there are multiple terminals, only the ports at each end of the network should have terminating impedance as described above. Also, for RS485 operation, there must be a bias on the RX+ and RX- lines. If the PCI-ICM485 card is not to provide that bias in your application, contact the factory.

Baud Rate Ranges

For each of the ports, jumpers labeled X1 and X4 provide means to select baud rates in either of two ranges. When in the "X1" position, the baud rate range is up to 115,200 baud. When in the "X4" position, the baud rate range is 200 to 460,800 baud. Refer to the Baud Rate Divisor Table on page 5-2 of the manual.

Interrupts

Please note that, in Windows NT systems, changes must be made to the system registry to support IRQ sharing. The following is excerpted from "Controlling Multiport Serial I/O Cards"provided by Microsoft in the MSDN library, documentid: mk: @ivt: nt40res/ D15/S55FC.HTM, also available in the WindowsNT Resource Kit.

The Microsoft serial driver can be used to control many dumb multiport serial cards. Dumb indicates that the control includes no on-board processor. Each port of a multiport card has a separate subkey under the HKLM\CurrentControlSet\Services\Serial subkey in the registry. In each of these subkeys, you must add values for DosDevices, Interrupt, InterruptStatus, PortAddress, and PortIndex because these are not detected by the Hardware Recognizer. (For descriptions and ranges for these values, see Regentry.hlp, the Registry help file on the WindowsNT Workstation Resource Kit CD.)

For example, if you have a four-port PCI-ICM card configured to use address 0xFC00, 0xFD00, 0xFD80, and 0xFE00 with an interrupt of 05, the values in the Registry are:

Serial2 subkey:
PortAddress = REG_DWORD 0xFC00
Interrupt = REG_WORD 5
DosDevices = REG_SZ COM3
InterruptStatus = REG_DWORD 0xFC08
PortIndex = REG_DWORD 1
Indexed =0

Serial4 subkey:
PortAddress = REG_DWORD 0xFD80
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM5
InterruptStatus = REG_DWORD 0xFC08
PortIndex - REG_DWORD 3
Indexed=0

Serial3 subkey:
PortAddress = REG_DWORD 0xFD00
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM4
InterruptStatus = REG_DWORD 0xFCO8
PortIndex = REG_DWORD 2
Indexed=0

Serial5 subkey:
PortAddress = REG_DWORD 0xFE00
Interrupt = REG_DWORD 5
Dos Devices = REG_SZ COM6
InterruptStatus = REG_DWORD 0xFC08
PortIndex = REG_DWORD 4
Indexed=0

As this example shows, the Interrupt status register, which indicates which port (s) caused an IRQ, is located at COM A Base Address +8.

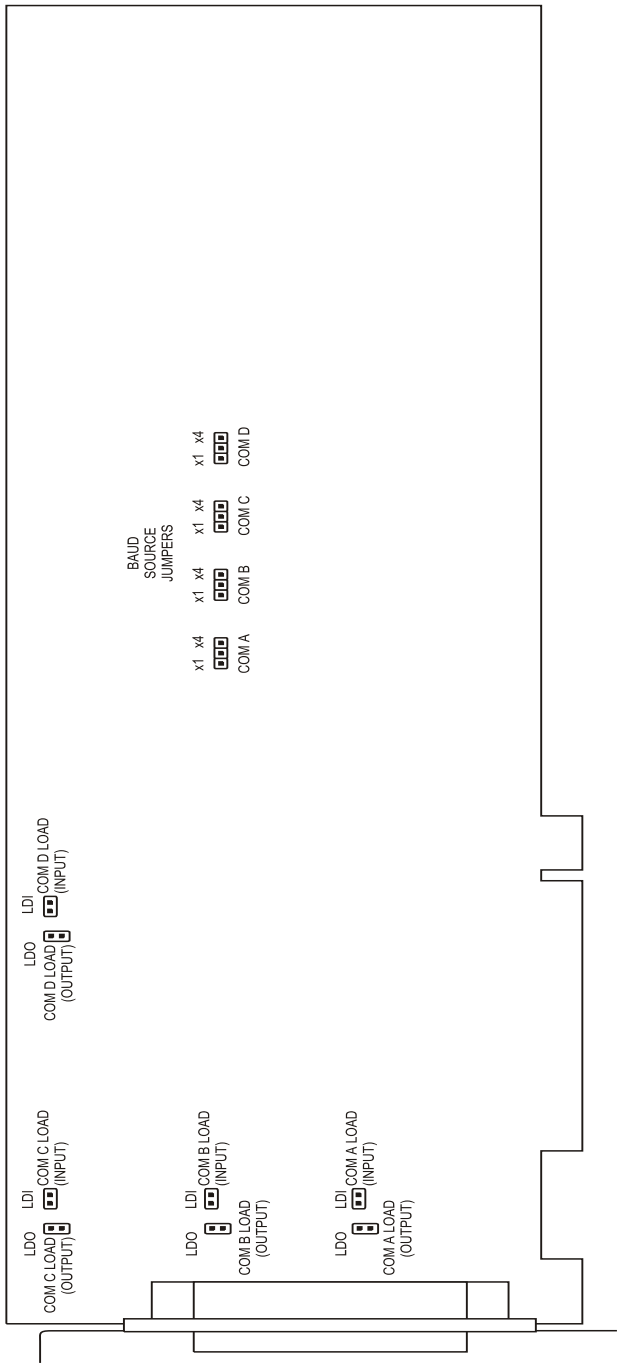

Figure 3-2: Option Selection Map

Chapter 4: Address Selection

The PCI-ICM422/4 and PCI-ICM485/4 use four separate address spaces. COM A occupies 16 consecutive address locations and COM B, COM C, and COM D each occupy eight consecutive register locations. The two-port versions of these cards do not have ports COM C and COM D.

PCI architecture is Plug-and-Play. This means that the BIOS or Operating System determines the resources assigned to PCI cards rather than you selecting those resources with switches or jumpers. As a result, you cannot set or change the card's base address. You can only determine what the system has assigned.

To determine the base address that has been assigned, run the PCIFind.EXE utility program provided. This utility will display a list of all of the ACCES cards detected on the PCI bus, the addresses assigned to each function on each of the cards, and the respective IRQs and DMAs (if any) allotted.

Alternatively, some operating systems (Windows95/98/2000) can be queried to determine which resources were assigned. In these operating systems, you can use either PCIFind or the Device Manager utility from the System Properties Applet of the control panel. These cards are installed in the Data Acquisition class of the Device Manager list. Selecting the card, clicking Properties, and then selecting the Resources Tab will display a list of the resources allocated to the card.

The PCI bus supports 64K of address space, so your card's addresses may be located anywhere in the 0000 to FFFF hex range. If you want to determine the base addresses and IRQ' assigned for yourself, use the following information:

The Vendor ID for these cards is 494F (ASCII for "I/O").

The Device ID for PCI-ICM422/2 is 1150h.
"" " PCI-ICM422/4 is 1158h.
"" " PCI-ICM485/4 is 1151h.
"" " PCI-ICM485/4 is 1159h.

Chapter 5: Programming

There are sample programs provided with the card in C, Pascal, QuickBASIC, and several Windows languages. DOS samples are located in the DOS directory and Windows samples are located in the WIN32 directory.

Initialization

Initializing the chip requires knowledge of the UART's register set. The first step is to set the baud rate divisor. You do this by first setting the DLAB (Divisor Latch Access Bit) high. This bit is Bit 7 at Base Address +3. In C code, the call would be:

```
outportb(BASEADDR +3,0x80);
```

You then load the divisor into Base Address +0 (low byte) and Base Address +1 (high byte). The following equation defines the relationship between baud rate and divisor:

desired baud rate = (UART clock frequency) / (32 * divisor)

When the BAUD jumper is in the X1 position, the UART clock frequency is 1.8432 Mhz. When the jumper is in the X4 position, the clock frequency is 7.3728 MHz. The following table lists popular divisor frequencies. Note that there are two columns to consider depending on the position of the BAUD jumper.

Baud Rate	Divisor x1	Divisor x4	Notes:	Max Diff. Cable Length *
460800	N/A	1		
230400	N/A	2		
153600	N/A	3		
115200	1	4		375 feet
57600	2	8		660 ft
38400	3	12		920 ft
28800	4	16		1165 ft
19200	6	24		1620 ft
14400	8	32		2050 ft
9600	12	48	Most common industrial speed	4000 ft
4800	24	96		4000 ft
2400	48	192		4000 ft
1200	96	384		4000 ft

* Recommended maximum distances for differentially driven data cables (RS422 or RS485) are for typical conditions.

Table 5-1: Baud Rate Divisor Values

In C, the code to set the chip to 9600 baud is:

```
outportb(BASEADDR, 0x0C);
outportb(BASEADDR +1,0);
```

The second initializing step is to set the Line Control Register at Base Address +3. This register defines word length, stop bits, parity, and the DLAB.

Bits 0 and 1 control word length and allow word lengths from 5 to 8 bits. Bit settings are extracted by subtracting 5 from the desired word length.

Bit 2 determines the number of stop bits. There can be either one or two stop bits. If Bit 2 is set to 0, there will be one stop bit. If Bit 2 is set to 1, there will be two.

Bits 3 through 6 control parity and break enable. They are not commonly used for communications and should be set to zeroes.

Bit 7 is the DLAB discussed earlier. It must be set to zero after the divisor is loaded or else there will be no communications.

The C command to set the UART for an 8-bit word, no parity, and one stop bit is:

```
outportb(BASEADDR +3, 0x03)
```

The final initialization step is to flush the receiver buffers. You do this with two reads from the receiver buffer at base address +0. When done, the UART is ready to use.

Reception

Reception can be handled in two ways: polling or interrupt-driven. When polling, reception is accomplished by constantly reading the Line Status Register at Base Address +5. Bit 0 of this register is set high whenever data are ready to be read from the chip. A simple polling loop must continuously check this bit and read in data as it becomes available. The following code fragment implements a polling loop and uses a value of 13, (ASCII Carriage Return) as an end-of-transmission marker:

```
do
{
  while (!(inportb(BASEADDR +5) & 1));    /*Wait until data ready*/
    data[i++]= inportb(BASEADDR);
}
  while (data[i]!=13);                    /*Reads the line until null character rec'd*/
```

Interrupt-driven communications should be used whenever possible and is required for high data rates. Writing an interrupt-driven receiver is not much more complex than writing a polled receiver but care should be taken when installing or removing your interrupt handler to avoid writing the wrong interrupt, disabling the wrong interrupt, or turning interrupts off for too long a period.

The handler would first read the Interrupt Identification Register at Base Address +2. If the interrupt is for Received Data Available, the handler then reads the data. If no interrupt is pending, control exits the routine. A sample handler, written in C, is as follows:

```
readback = inportb(BASEADDR +2);
if (readback & 4)                    /*Readback will be set to 4 if data are available*/
data[i++]=inportb(BASEADDR);
outportb(0x20,0x20);                 /*Write EOI to 8259 Interrupt Controller*/
return;
```

Transmission

RS485 transmission is simple to implement. The AUTO feature of the PCI-ICM422/485 card automatically enables the transmitter when data are ready to send. No software enabling is required.

The following C code fragment demonstrates this process:

```
while(data[i]);                                  /*While there is data to send*/
{
 while(!(inportb(BASEADDR +5)&0x20));            /*Wait until transmitter is empty*/
 outportb(BASEADDR,data[i]);
 i++;
}
```

Chapter 6: Connector Pin Assignments

A breakout cable is delivered with each card. The cable mates with a 37-pin connector on the card mounting bracket and, at the other ends of the cable, the popular 9-pin D sub-miniature male connector is used to interface with your communication lines. Those connectors are equipped with 4-40 threaded standoffs (female screw lock) to provide strain relief.

Pin	RS422 Signals	RS485 Signals
1	Rx-	
2	Tx+	Tx+ and Rx+
3	Tx-	Tx- and Rx-
4		
5	Ground	Ground
6		
7		
8		
9	Rx+	

Table 6-1: Connector Pin Assignments

The cards can be ordered without the breakout cable. In that case your communication cables will connect directly to the 37-pin D style connector on the card mounting bracket. Pin assignments are as follows:

Com Port A		**Com Port C**	
Pin 37	Tx+	Pin 27	Tx+
Pin 19	Tx-	Pin 9	Tx-
Pin 17	Rx+	Pin 7	Rx+
Pin 36	Rx-	Pin 26	Rx-
Pin 18	GND Ground	Pin 8	GND Ground
Com Port B		**Com Port D**	
Pin 32	Tx+	Pin 21	Tx+
Pin 14	Tx-	Pin 3	Tx-
Pin 12	Rx+	Pin 1	Rx+
Pin 31	Rx-	Pin 20	Rx-
Pin 13	GND Ground	Pin 2	GND Ground

Note

For RS485 applications, inputs and outputs should be connected to the Tx+ and Tx- pins at each port.

Appendix A: Application Considerations

Introduction

Working with RS422 and RS485 devices is not much different from working with standard RS232 serial devices and these two standards overcome deficiencies in the RS232 standard. First, the cable length between two RS232 devices must be short; less than 50 feet at 9600 baud. Second, many RS232 errors are the result of noise induced on the cables. The RS422 standard permits cable lengths up to 5000 feet and, because it operates in the differential mode, it is more immune to induced noise.

Connections between two RS422 devices (with CTS ignored and 25-pin connectors) should be as follows:

Device #1		**Device #2**	
Signal	Pin No.	Signal	Pin No.
Gnd	7	Gnd	7
TX^+	24	RX^+	12
TX^-	25	RX^-	13
RX^+	12	TX^+	24
RX^-	13	TX^-	25

Table A-1: Connections Between Two RS422 Devices

A third deficiency of RS232 is that more than two devices cannot share the same cable. This is also true for RS422 but RS485 offers all the benefits of RS422 plus allows up to 32 devices to share the same twisted pairs. An exception to the foregoing is that multiple RS422 devices can share a single cable if only one will talk and the others will all receive.

Balanced Differential Signals

The reason that RS422 and RS485 devices can drive longer lines with more noise immunity than RS232 devices is that a balanced differential drive method is used. In a balanced differential system, the voltage produced by the driver appears across a pair of wires. A balanced line driver will produce a differential voltage from ±2 to ±6 volts across its output terminals. A balanced line driver can also have an input "enable" signal that connects the driver to its output terminals. If the "enable signal is OFF, the driver is disconnected from the transmission line. This disconnected or disabled condition is usually referred to as the "tristate" condition and represents a high impedance. RS485 drivers must have this control capability. RS422 drivers may have this control but it is not always required.

A balanced differential line receiver senses the voltage state of the transmission line across the two signal input lines. If the differential input voltage is greater than +200 mV, the receiver will provide a specific logic state on its output. If the differential voltage input is less than -200 mV, the receiver will provide the opposite logic state on its output. A maximum operating voltage range is from +6V to -6V allows for voltage attenuation that can occur on long transmission cables.

A maximum common mode voltage rating of ±7V provides good noise immunity from voltages induced on the twisted pair lines. The signal ground line connection is necessary in order to keep the common mode voltage within that range. The circuit may operate without the ground connection but may not be reliable.

Parameter	Conditions	Min.	Max.
Driver Output Voltage (unloaded)		4V	6V
		-4V	-6V
Driver Output Voltage (loaded)	LD and LDGND	2V	
	jumpers in	-2V	
Driver Output Resistance			50Ω
Driver Output Short-Circuit Current			±150 mA
Driver Output Rise Time			10% unit interval
Receiver Sensitivity			±200 mV
Receiver Common Mode Voltage Range			±7V
Receiver Input Resistance			4KΩ

Table A-2: RS422 Specification Summary

To prevent signal reflections in the cable and to improve noise rejection in both the RS422 and RS485 mode, the receiver end of the cable should be terminated with a resistance equal to the characteristic impedance of the cable. (An exception to this is the case where the line is driven by an RS422 driver that is never "tristated" or disconnected from the line. In this case, the driver provides a low internal impedance that terminates the line at that end.)

Note

You do not have to add a terminator resistor to your cables when you use the PCI-ICOM cards. Termination resistors for the RX+ and RX- lines are provided on the card and are placed in the circuit when you install the jumpers. (See the Option Selection section of this manual.)

RS485 Data Transmission

The RS485 Standard allows a balanced transmission line to be shared in a party-line mode. As many as 32 driver/receiver pairs can share a two-wire party line network. Many characteristics of the drivers and receivers are the same as in the RS422 Standard. One difference is that the common mode voltage limit is extended and is +12V to -7V. Since any driver can be disconnected (or tristated) from the line, it must withstand this common mode voltage range while in the tristate condition.

The following illustration shows a typical multidrop or party line network. Note that the transmission line is terminated on both ends of the line but not at drop points in the middle of the line.

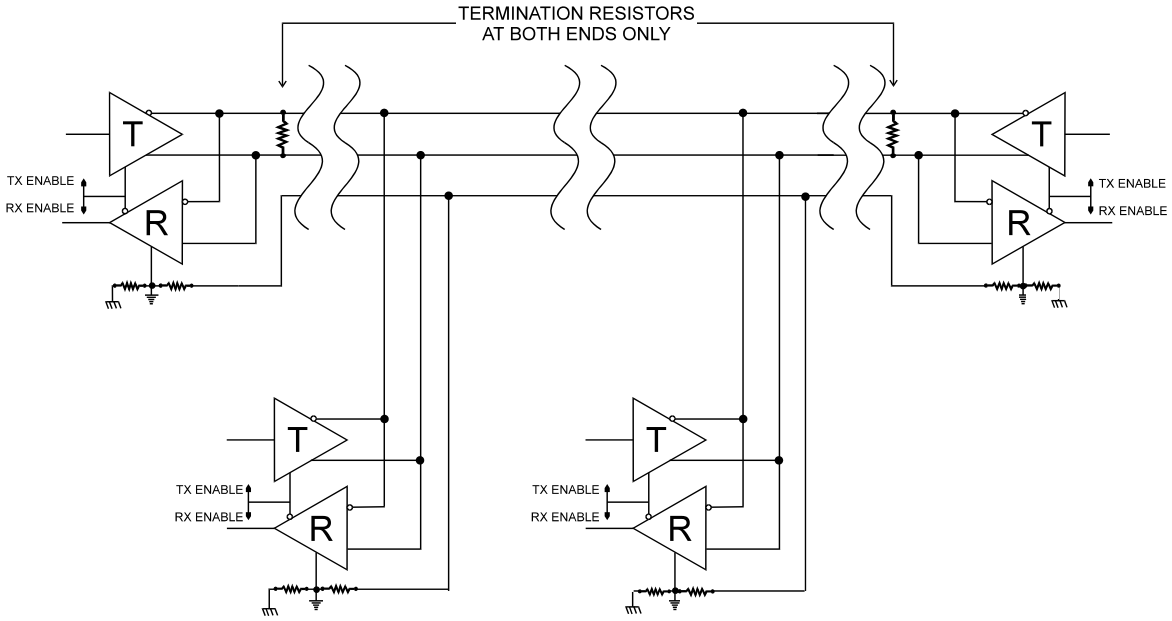

Figure A-1: Typical RS485 Two-Wire Multidrop Network

RS485 Four-Wire Multidrop Network

An RS485 network can also be connected in a four-wire mode. In a four-wire network it's necessary that one node be a master node and all others be slaves. The network is connected so that the master communicates to all slaves and all slaves communicate only with the master. This has advantages in equipment that uses mixed protocol communications. Since the slave nodes never listen to another slave's response to the master, a slave node cannot reply incorrectly.

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: ***manuals@accesioproducts.com.***. Please detail any errors you find and include your mailing address so that we can send you any manual updates.

ACCES I/O PRODUCTS, INC.
10623 Roselle Street, San Diego CA 92121
Tel. (858)550-9559 FAX (858)550-7322
www.accesioproducts.com